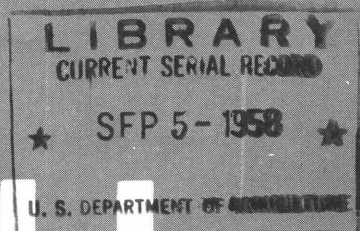


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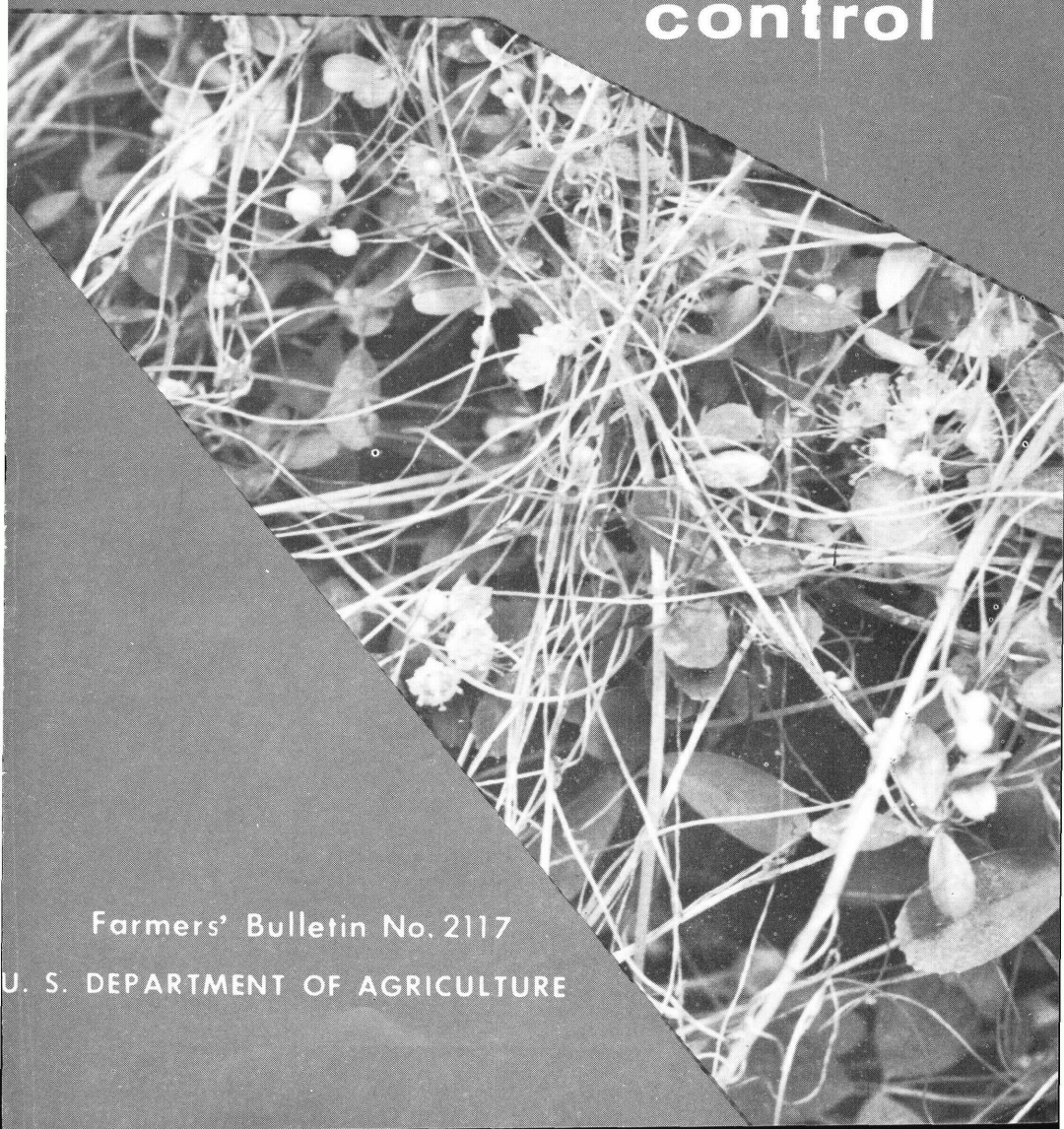
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# dodder

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control



Farmers' Bulletin No. 2117

U. S. DEPARTMENT OF AGRICULTURE

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# dodder AND ITS CONTROL

By W. O. LEE and F. L. TIMMONS, *research agronomists,*  
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In recent years more and more farmers have been reporting trouble caused by the weed commonly known as dodder or love vine, a parasite that attacks alfalfa, lespedeza, and other crop plants. Such complaints have come from nearly all the Western States and from many of the North Central and Southern States (table 1). In areas of the North Central and Southern States where lespedeza is grown this weed often prevents production of lespedeza seed crops, and

on some farms in the West it has put an end to profitable growing of alfalfa for any purpose. Where dodder infesting alfalfa or lespedeza still permits production of seed crops, it causes large money losses by reducing seed yields, lowering seed quality, interfering with machine harvesting, and adding to the cost of cleaning seed. Other crops in which losses result from dodder infestation include clovers, flax, onions, sugar beets, and some ornamentals.

TABLE 1.—*States in which dodder is reported to create a severe problem in one or more crops*<sup>1</sup>

Region	States reporting a severe dodder problem in—			
	Alfalfa	Lespedeza	Clovers <sup>2</sup>	Other crops <sup>3</sup>
Western -----	{ Utah Idaho Washington California Colorado Montana New Mexico Nevada Wyoming Oregon }	{ None }	{ California Idaho Colorado }	{ Idaho }
North-central -	None	{ Missouri Indiana Ohio Illinois North Carolina Tennessee Kentucky Arkansas Oklahoma South Carolina }	{ Wisconsin Ohio }	{ Iowa Missouri North Dakota }
Southern -----	{ Oklahoma Texas }	{ Kentucky Arkansas Oklahoma South Carolina }	{ Florida }	North Carolina

<sup>1</sup> Under each crop, States are listed in the approximate order of severity of their dodder problems in that crop.

<sup>2</sup> Alsike, red, white, and ladino clovers.

<sup>3</sup> Vegetables and ornamentals.

Dodder has been legislated against more than any other weed. All the States have laws at least limiting the percentage of dodder seed contained in crop seed offered for sale. In some States, crop seed cannot legally be sold if it contains any dodder seed whatever. Nevertheless the weed continues to increase rapidly in many of the areas where growing conditions favor it. Its presence should be considered a serious threat wherever crop plants susceptible to it are grown.

Like other troublesome weeds, dodder has different names in different localities. Common names in addition to dodder and love vine include strangleweed, devil's-guts, goldthread, pull-down, devil's ringlet, hellbind, hairweed, devil's-hair,

and hailweed. Some species of the weed are called by such names as alfalfa dodder and clover dodder, according to what plants they live on.

A farmer can prevent dodder from getting onto his farm, or spreading from field to field, much more easily than he can eradicate it after it has once gained a foothold. When the weed does gain a hold on a farm, a plan of attack should be carefully drawn up and then faithfully followed. Such a plan should take into account whether the infestation is scattered or widespread and whether a different cropping system might well be substituted in order to cope with the dodder.

## WHAT DODDER LOOKS LIKE

When dodder has grown large enough to become noticeable, it is a slender, twining parasite (fig. 1). The tough, threadlike, curling stems usually have a yellowish to orange color, sometimes tinged with red or purple. Occasionally, they are almost white. They have no leaves other than a few very small scales.

During late spring and much of the summer dodder bears massed clusters of flowers (fig. 2), which may be either white, pink, or yellowish. At the flowering stage, the stems of a small-seeded species are still very slender and show up less conspicuously than its dense flower clusters, but the stems of a large-seeded species are thicker and are long enough to overtop alfalfa.

In a field of alfalfa, lespedeza, or another legume crop, dodder commonly appears first as a few scattered yellowish patches. If the crop is grown for seed and the dodder is allowed to produce seed with the result that it spreads widely, its yellowish color may predominate over the green of the legume in large parts of the field (fig. 3) or even throughout the field.

Dodder seed (fig. 4) vary in color from gray to reddish brown or black and have a rough, pitted seed-coat. According to species, they range in diameter from less than 1 millimeter to 2 millimeters. Most dodder seed are roughly spherical in shape; but usually each seed has 1 to 3 flat faces, according to the number of seeds in a capsule.

## DODDER SPECIES AND THEIR HOSTS

Species of dodder that have been found in the United States, including both native and introduced species, total about 44. Only a small

fraction of this number can cause trouble in cultivated crops. The different species look very much alike; only an expert can tell one



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**Figure 1.—Dodder, on alfalfa, in a vegetative (prebloom) stage.**

from another. In this bulletin, therefore, different dodder species are not described in detail.

Some of the troublesome dodder species infest only a few plants, but others have many different hosts. Under some circumstances it is important to identify the species, or each of the species, of dodder present on a farm and learn its life history and growth habits. For example, small-seeded alfalfa dodder, which causes extensive damage throughout the West, seldom harms any crop except alfalfa, though it grows on other plants. Flax dodder infests practically no crop other than flax. Common dodder and field dodder, on the other hand, attack plants differing as widely as onion, sugar beet, and ornamentals. Clover dodder rarely seeds in the

United States; therefore, in most localities, it is to be feared only during the first season after a crop is planted. It is suggested that a farmer needing to have dodder identified ask for help from the agricultural college of his State or from the United States Department of Agriculture.

None of the dodders affect small grains, corn, or other members of the grass family under field conditions. None do serious damage to such large-seeded legumes as peas or beans or to potatoes, carrots, or some other field and vegetable crops.

The six species of dodder causing the most damage in the United States are briefly discussed in the following paragraphs:



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**Figure 2.**—Dodder, on alfalfa, at the flowering stage. The stems of a small-seeded species (A), still threadlike, and its dense flower clusters are concentrated near the base of the host plant. A large-seeded species (B) has thicker, longer stems, which overtop the alfalfa, and fewer flowers.



Figure 3.—A lespedeza field heavily infested with field dodder.

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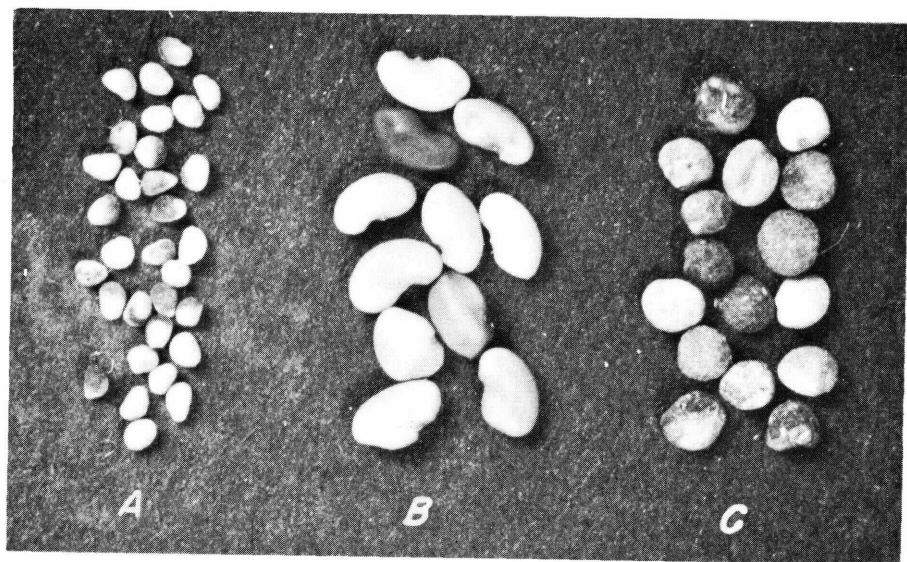


Figure 4.—Seed of small-seeded alfalfa dodder (A), alfalfa (B), and large-seeded alfalfa dodder (C), magnified to four times their actual size. The seed of large-seeded alfalfa dodder are especially hard to clean from alfalfa seed because they resemble them in size. Dodder seed have rough seedcoats, whereas alfalfa seed have smooth ones.

BN-5433

**LARGE-SEEDED ALFALFA DODDER** (*Cuscuta indecora*).—Large-seeded alfalfa dodder shows a decided preference for leguminous crop plants, particularly alfalfa. It attacks a number of other plants, also. It is a native species common in the West, found rarely in the East and occasionally in the South. Its seed (fig. 4) resemble those of alfalfa or red clover in size and so are especially hard to separate from them.

**SMALL-SEEDED ALFALFA DODDER** (*Cuscuta planiflora*).—Small-seeded alfalfa dodder, a species introduced from southern Europe, causes serious losses in alfalfa in the West but is not found in the East. This species has smaller stems and makes much less growth than others. For these reasons, patches of small-seeded alfalfa dodder are hard to find for spot treatment. Seed of this species (fig. 4) mature before it becomes possible to harvest first-crop alfalfa seed.

**FIELD DODDER** (*Cuscuta pentagona*).—Field dodder, one of the most destructive of all dodders, is a large-seeded native species that grows on most leguminous crop plants and also on other broad-leaved plants, both cultivated and wild, showing little preference among its hosts. It attacks lespe-deza more commonly than any other dodder. Its stems have a pale yellow color, which helps in identifying it in the field. Field dodder grows in most parts of the United States. In certain years this species is unusually prevalent because weather conditions favor its development. Its seed, like those of the large-seeded alfalfa dodder (fig. 4), are about the same size as the seed of alfalfa or red clover.

**COMMON DODDER** (*Cuscuta gro-novii*).—Common dodder, a native species, is the one most often complained of as attacking vegetables and flowering ornamentals. It also

infests hedge plants, willows, and other types of woody ornamentals. This species resembles field dodder in lacking strong preferences among its hosts.

**CLOVER DODDER** (*Cuscuta epithy-mum*).—Clover dodder, an introduced species, shows a decided preference for clover and alfalfa. It is found in parts of the West and occasionally in the East. It does its greatest damage to the first year's crop resulting from sowing infested seed. Because it rarely produces seed in the United States and because little foreign clover or alfalfa seed is now used here, this species has become less important than it was in earlier years when we imported much of our clover seed from Europe.

**CHILEAN DODDER** (*Cuscuta suave-olens*).—Chilean dodder, a common South American species, causes some losses of clover and alfalfa in the Mississippi Valley and in California. It has never spread widely in any part of the United States.

Species of dodder that infest crop plants also have a large number of hosts among wild shrubs and herbs. These include willow, aster, sagebrush, goldenrod, four-o'clock, ragweed, nettle, purslane, yellow trefoil, pigweed, sunflower, caltrop, wild carrot, shepherds-purse, hazel, chondrilla, dandelion, viburnum, marsh-elder, fleabane, horsetrill, and honeysuckle. Whenever any of these plants grow in fields where dodder is a problem, they may act as alternate hosts and seed of dodders that damage crops may be added regularly to the soil even if susceptible crops are not being grown.

Because the importance of dodder arises principally from the damage it causes in alfalfa and lespe-deza, the term "dodder" as used in following sections of this bulletin refers to dodders infesting these crops, unless otherwise specified.

## LIFE HISTORY

To illustrate the life history of a dodder plant, we will outline that of large-seeded alfalfa dodder. Like all other dodders, this species reproduces from seed (figs. 4 and 5). The seed germinates (fig. 5, *b*) in the soil and uses all its stored-up food in producing a shoot, 4 or 5 inches long, resembling a gold thread (fig. 5, *c*). The leafless, almost rootless shoot rotates until, if possible, it comes into contact with a host plant. Seedlings of some species of dodder may attack almost any plant within reach but will leave any other plant as soon as they have climbed within reaching distance of alfalfa or lespedeza plants. If a seedling does not come into contact with a host, its temporary stem lies dormant on the soil for 4 or 5 weeks and then dies.

A shoot that comes into contact with a host plant begins to climb by encircling it (fig. 5, *d*). When the dodder stem has made close contact with the stem of the host plant, small suckers (called haustoria) grow out of it, like warts, and penetrate the food-conducting tissues of the host plant (fig. 6). Through these suckers the dodder draws elaborated food, which it uses in making growth. The suckers secrete a substance, called diastase, that dissolves starchy substances in the host. Once the two plants become united, the base section of the dodder stem shrivels and dries, so that the plant loses all contact with the ground (fig. 5, *e*). From that time on, the parasite obtains all its food material and water at the expense of the host plant.

As the dodder plant grows it continues to climb, branching and re-branching continually. As soon as its branches become long enough they begin to attack nearby plants

(fig. 5, *f*). In the course of time, a single dodder plant may form a patch many feet across.

As this growth goes on, frequently the plants first attacked are killed back to the roots. This causes the dodder on them to die, but it does not affect the dodder that has spread from them to host plants at the edge of the infested area. As new growth starts from the crowns of the crop plants, it is attacked by the branching stems of established dodder plants or by dodder seedlings that have newly germinated in the soil. Again, the top growth of the host plants is killed. After several attacks, the host plant often dies.

Dodder flowers from late spring until frost. The seed is formed in great abundance during much of the summer and ripens from early summer until frost. Some of it may germinate immediately after falling to the ground; much of it may lie dormant on the soil surface for 5 years or more and then germinate. Half-ripe dodder seeds germinate as readily as those that have matured, but they may not remain viable as long in a dormant state.

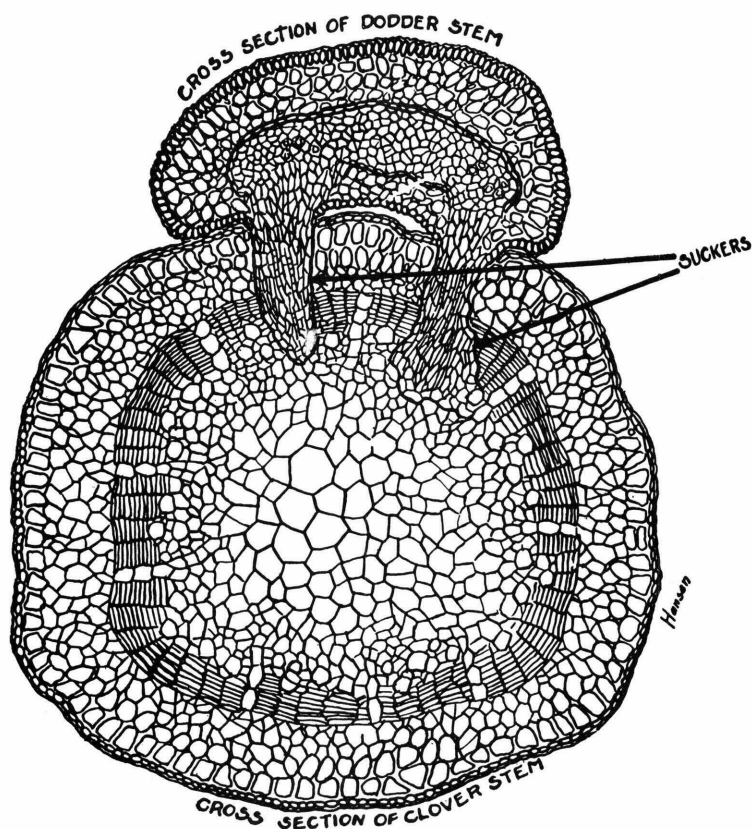
In most areas of the United States where dodder grows, the plant overwinters by means of seed. In areas that are free of severe frost, a few plants overwinter in stems of the host that are protected from freezing by a covering of soil or crop residue. Such plants begin to grow again when the favorable weather conditions of spring arrive.

In the West, dodder produces seed every year; elsewhere, in an occasional year unfavorable weather prevents it from producing seed or even flowering.



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**Figure 5.**—Stages of the life cycle of large-seeded alfalfa dodder on alfalfa. *a*, Seed. *b*, Germination of the seed. *c*, The young seedling rotates. If it does not come into contact with a host plant it will die. *d*, A seedling that has come into contact with a host plant winds itself around the host's stem. *e*, Having sent tiny suckers into the host's tissues and begun to draw nutrients through them from the host, the dodder climbs to the upper parts of the host. The lower part of its stem then withers, leaving it disconnected from the ground. The dodder will continue to grow until the alfalfa matures or is killed. *f*, Dodder tendrils reaching out from the alfalfa plant that was attacked first (at left). Both the alfalfa and the dodder are flowering. *g*, The dodder plants have matured seed. The alfalfa plants, likewise, have done so, although their seed yield has been seriously reduced by the parasites. The alfalfa plant attacked first (at left) has withered and is about to die to the roots, owing to the parasite. Withering of the host is causing the attached dodder plant to wither. The more recently attacked host shows signs of withering, but the dodder on it still remains vigorous.



BN-5431

**Figure 6.**—Cross section of clover stem and attached dodder stem, greatly enlarged. Note the two suckers (haustoria) by means of which the dodder extracts nutrients from the clover.

## HOW DODDER SPREADS

When dodder makes its first appearance on a farm, this is likely to mean that the farmer has planted dodder seed. Often he is in danger of doing so if he uses crop seed that was grown by a neighboring farmer or that he bought without learning its source. If even a few dodder plants are allowed to produce seed in a field where a legume crop is being grown for seed, within a few years the dodder seed may be scattered over the whole field in the process of harvesting with a combine.

Rapid spread of dodder is likely

to be caused, also, by moving a combine from field to field or from farm to farm without cleaning it properly. Manure or mud containing the seed adheres to farm equipment, the hoofs of animals, and the shoes of men and thus is carried from place to place.

Transporting and feeding hay containing dodder seed likewise causes spread of the weed. It should be remembered that dodder cut with a hay crop often matures seed even if it was only in the flower stage when cut.

Dodder seed can pass through the

digestive tract of an animal and still germinate. Thus, if animals are fed hay that contains dodder seed, their manure is spread on a field, and the field is used at any time within 5 years for growing a

crop susceptible to dodder, plants from some of that seed are likely to show up as parasites.

In irrigated areas of the West, irrigation water frequently carries dodder seed from field to field.

## HOW TO KEEP DODDER FROM SPREADING

Here are rules for preventing spread of dodder:

1. Do not sow crop seed that contains dodder seed.

Clean crop seed has become available to all farmers, through the work of seed-certifying organizations in 43 of the 48 States. Certified seed is labeled with reliable statements on kinds and percentages of weed seed present. So far as possible, plant only tagged, certified seed or other seed of known purity. If you intend to grow a crop that is susceptible to dodder and cannot get seed of known quality, learn to recognize dodder seed (see p. 2) and look for it in all susceptible-crop seed of unknown purity.

2. Before moving a combine or other farm equipment from a field known to be infested with dodder

to one not known to be infested, clean it thoroughly.

3. Destroy any hay containing dodder seed unless you absolutely must feed it. If you feed it, confine the animals to a feed lot, to the field where the hay originated, or to a field where susceptible crops are not likely to be grown. Forage crops infested with dodder that has not yet matured seed can be harvested with a field chopper, to be dehydrated and made into alfalfa meal or to be fed green or as silage, without danger of spreading viable dodder seed.

4. Do not spread on dodder-free land any manure that you suspect of containing dodder seed.

5. Do not allow dodder to grow along irrigation ditches where water could carry the seed from place to place.

## CONTROLLING SCATTERED PATCHES IN FIELD CROPS

Because dodder is an annual plant, coming from seed each year, any program for controlling it aims chiefly at destroying the plant before it can produce seed. The only known way to kill dodder attached to field-crop plants is to kill the host plants to a point below where the dodder is attached.

As the first step in controlling a scattered infestation, the farmer should go over the whole field and locate the patches. If the dodder present is mainly of one or more large-seeded species, often he can spot the plants more easily from horseback; if it is small-seeded, the patches are harder to locate and

the patrolling job can usually be done better on foot. He should mark each dodder patch with a white or yellow flag, so that it can easily be relocated for treatment.

In alfalfa, lespedeza, and most of the other field crops attacked by dodder, a scattered infestation can be controlled by spraying with certain weed oils or other herbicides, by burning, by cutting, or by combining two of these methods. Such treatments must be continued for several years. For more certain and lasting results, it is sometimes desirable to apply chemicals that sterilize the soil.

## Spraying With Oils

Among the most effective sprays for controlling dodder patches are (1) aromatic weed oils and (2) diesel or other fuel oil that has been fortified with DNBP (4,6-dinitro ortho secondary butyl phenol) weed killer. In mixing DNBP into oil, use 1 pint of it to 50 gallons of oil. Any of these oils can be applied with a knapsack sprayer (fig. 7) or a power sprayer equipped with a 25- or 50-foot hose and a hand gun. Enough spray must be used to give complete coverage of the host plant and the dodder. Because of the higher spraying pressures that can be developed with it, a power sprayer is sometimes preferable where very heavy foliage makes penetration a problem. Where a power sprayer equipped with an agitator is available, an emulsion of dinitro-fortified fuel oil and water may be used. Prepare this spray by mixing 3 pints of DNBP, 20 gallons of diesel or other fuel oil, and enough water to make 100 gallons of spray. The treatments just described kill the host plant to the ground, but they do not cause permanent injury to perennial crop plants such as alfalfa.

Some farmers prefer to apply fuel oil, crankcase oil, or some similar material with a sprinkling can and then burn the spot. This method is effective, but it requires much more oil and much more labor than spraying with any of the chemicals commonly sold as herbicides and thus is more expensive.

In annual lespedeza, the stand of which can be killed out in spots without serious loss, 2,4-D sprays have been used successfully. Such a treatment is much cheaper than the weed oils or other contact herbicides generally used in perennial crops.

## Burning

Burning with a weed burner (fig. 8) destroys dodder patches effectively at rather low cost. Burners fueled with propane or butane have proved to be the best suited to this purpose. For economy and convenience the burner should be equipped with a pilot light and trigger valve, so that it need not be kept in operation except when patches are actually being burned. One unit that has been used very effectively consists of a 320-gallon propane tank mounted on a 2-wheeled trailer, two 50-foot hoses, and two hand burning units (fig. 8, B). As the tank is pulled along, the burners can be used on either side of it and thus the dodder patches within a strip 100 feet wide can be destroyed in each trip through the field.

Kerosene burners have not proved satisfactory for controlling dodder.

If patches of dodder are burned before they set seed, it is usually possible to get a good top kill without charring the vegetation. Where seed have formed, it may be desirable to burn the plants severely to destroy the seed. If most of the patches have set seed, the best procedure may be to kill the top growth with a light burning and then go back several days later, when the vegetation has dried, and burn the patches clean.

## Cutting

In the past farmers have used scythes, shovels, hoes, and other cutting tools to destroy dodder patches. They have cut the host plants below the point at which the dodder was attached, and then have usually removed the cut vegetation from the field in sacks or, after allowing it to dry on the spot, sprinkled it with oil or covered it with



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**Figure 7.—A, Applying aromatic oil to a dodder patch in alfalfa with a knapsack sprayer; B, the darkened spot marked by the stake at the left is alfalfa and attached dodder that have been killed to the ground by the spray.**



BN-5439

**Figure 8.—Weed burners for spot treatment: A, Single hand burner with 16-gallon propane tank; B, large unit composed of 320-gallon propane tank mounted on a 2-wheeled trailer, two 50-foot hoses, and two hand burning units.**

some such material as straw and burned it. These methods give good results, but they are difficult and require much time and labor. They cannot be used economically unless (1) the patches are too few to warrant buying special equipment needed for spraying or burning or (2) only a few scattered plants have produced mature seed.

### **Sterilizing Soil**

Some growers of foundation or certified alfalfa or lespedeza seed prefer to treat small, widely scattered dodder patches with a soil-sterilizing chemical that kills both the dodder and the crop and prevents any growth of either host weeds or crop for 2 or more years. Before such a treatment is given, the top growth of both dodder and crop should be destroyed by burning, spraying with oil, or cutting and burning. Any dodder seed that germinates in the sterile soil dies because no host plant is available. Also, the treated areas are easily located in later years for further treatment to prevent dod-

der from developing on them or at their borders. Because this method destroys soil productivity for 2 or more years, it is not suitable where dodder patches are large or numerous.

### **Special Precautions**

Regardless of what method of spot treatment is used, these precautions are needed for success: (1) Treat the infested patches as soon as you can locate them, preferably before seed begins to form. (2) Treat several feet beyond the apparent edge of each patch, to kill dodder strands that reach out from the main patch and are hard to see. (3) Patrol the field at weekly intervals to spot new patches as they develop. (4) Revisit all treated patches 1 week after treatment and every 2 weeks thereafter to kill any dodder plants that have survived treatment and any new ones that may have come from seed. (5) If alfalfa or clover is to be raised the following year, mark the treated areas so they can be relocated and inspected for dodder.

## **CONTROLLING A WIDESPREAD INFESTATION OF A FIELD CROP**

Once dodder has spread over a field too widely to be controlled by spot treatment, control becomes very difficult and expensive, at best.

Methods for controlling a widespread infestation in a seed crop have been developed only for alfalfa.

### **Control in Alfalfa Seed Crops**

Methods for controlling a widespread dodder infestation in an alfalfa seed field include cultivation, application of chemicals, and burning. These methods cannot be used in some of the areas where alfalfa seed is now grown, because of soil and moisture conditions. Also, they seldom give 100-percent control. Where they can be used,

however, they can reduce the infestation to an extent that makes it possible to produce seed at a profit. A farmer should not undertake to grow alfalfa seed in a field where much dodder seed is present unless careful study indicates that the probable value of the seed crop is enough larger than that of a hay crop to justify the extra control cost.

### **First-Crop Versus Second-Crop Production of Seed**

The decision whether to harvest seed as the first or as the second crop of the season has an important bearing on the chance of successfully producing alfalfa seed in a field where much dodder seed is

present on and in the soil. Usually this decision depends in part on the value of hay, the time of emergence of wild bees, the length of the growing season, and the average seed yields of first-crop and second-crop alfalfa under local conditions.

Doddgers of the small-seeded type tend to develop early in the season and to mature seed before the time for harvesting first-crop alfalfa seed. Thus, if the small-seeded type predominates it is generally inadvisable to raise first-crop alfalfa seed. Large-seeded doddgers usually develop later in the season. Where they are the problem species, first-crop alfalfa seed can sometimes be harvested before the dodder does severe damage or matures seed—particularly in cool, wet seasons, when the dodder develops slowly.

An alfalfa field in which much dodder seed is present should be inspected about a week before the time when first-crop hay is usually cut. At this time no dodder patches will be large and probably none will show above the alfalfa. Thus, it will be necessary to look at the bases of the alfalfa plants for dodder just starting rapid growth and for dodder seedlings not yet attached. If a considerable quantity of dodder is found, it is probable that a severe infestation would develop before the time for harvesting first-crop alfalfa seed. Therefore, instead of trying to grow first-crop seed the farmer should cut hay immediately and destroy the dodder already present. If few or no dodder plants are found, first-crop alfalfa seed probably can be produced fairly free from dodder. In such a situation growing first-crop seed is advisable, because of the possibility or even likelihood that a heavy infestation would develop in a second crop grown for seed.

### **First-Crop Seed**

**CULTIVATION.**—Cultivation has been used successfully to control dodder in first-crop alfalfa seed in western areas where little rain falls in late spring or summer and soil moisture conditions permit producing the seed without irrigation or with only 1 or 2 irrigations a year. Where any irrigation is necessary, the field should be irrigated early in the season. This will tend to hasten germination of dodder seed and also will put the soil into better condition to be cultivated. If a second irrigation is needed it should be delayed, as nearly as possible, until the alfalfa is ready to bloom. Germination of dodder seed usually begins in the spring about the time alfalfa begins new growth from the crowns, and continues for several weeks. Before any dodder has become attached to alfalfa shoots the field should be cultivated thoroughly, to kill dodder seedlings as they develop (fig. 9) and to dry the surface soil to a state unfavorable for germination. Repeat the cultivation frequently until germination comes to an end.

Alfalfa growth is slowed down by cultivation, but it picks up uniformly when cultivation stops, and no permanent unfavorable effects on it have been noted. If the surface soil remains dry, very good control can usually be expected. If irrigation or rain follows cultivation, some dodder may develop. Even so, the infestation is greatly reduced, and in most instances whatever dodder develops does so too late to affect the alfalfa seed crop seriously.

Cultivation with any implement gives good results if it thoroughly stirs the surface soil, exposing it to drying. A harrow with curved spiked teeth is favored in several areas. Where alfalfa has been planted in rows, a lister might be



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**Figure 9.**—Dodder seedlings not yet attached to a host plant. This early-spring stage is the right one at which to begin cultivating for control of dodder in an alfalfa seed crop.

used to build ridges before other cultivation begins.

**CHEMICALS.**—The chemical CIPC (isopropyl N-(3-chlorophenyl) carbamate), as an emulsifiable liquid, has given good dodder control where it was applied at rates of 6 to 10 pounds per acre at the time alfalfa growth began in the spring, or soon thereafter, and cool, damp weather followed the application. Where hot, dry weather followed before the alfalfa made enough growth to shade the ground, the results have usually been unsatisfactory. Emulsifiable CIPC evaporates rapidly from the soil when soil temperature rises above 70° F. Thus it is believed that

where high temperatures follow application the chemical is lost from the soil before much of the dodder seed germinates.

A granular form of CIPC can be broadcast by airplane or by ground-rig applicator on alfalfa that has reached a height of 8 to 12 inches without injury to the crop. Growers have used it in this way to a limited extent. According to their results this delayed application of granules, if it is made before dodder seed germinates, appears to give control over a longer period than spray applications made when alfalfa first begins to grow.

Because CIPC treatment costs

\$15 to \$30 per acre and its success depends largely upon the weather that follows it, at the time of publication of this bulletin the treatment is not being recommended except for testing on a small scale. The chances of good results with CIPC are best in western areas where early-spring weather is normally cool and wet, effective rainfall is lacking in late spring and summer, and irrigation does not become necessary at least until the alfalfa reaches the bloom stage.

The chemical CDEC (2-chloroallyl diethyldithiocarbamate) also shows promise for control of dodder. It is applied in the same way and at the same rates as CIPC and appears to remain effective in the soil somewhat longer. At the time of publication of this bulletin CDEC is suggested only for testing on small areas.

### **Second-Crop Seed**

Where second-crop seed is raised, burning or cultivating the alfalfa stubble can give satisfactory control of dodder. The success of these treatments depends upon adequate rainfall or irrigation at the right time, destruction of any dodder that remains attached to the alfalfa stubble after first-crop hay is removed, dryness of the soil surface after the treatment, and other conditions unfavorable for further germination of dodder seed.

**BURNING.**—Burning alfalfa stubble after removal of first-crop hay controls dodder very effectively. On irrigated land where stubble is to be burned, the usual practice is to irrigate just before cutting, in order to hasten the start of any new dodder and make irrigation after the treatment unnecessary. The hay is removed as soon as possible after the cutting, so that the burning can be done before much regrowth starts. Several types of field burner (fig. 10) are

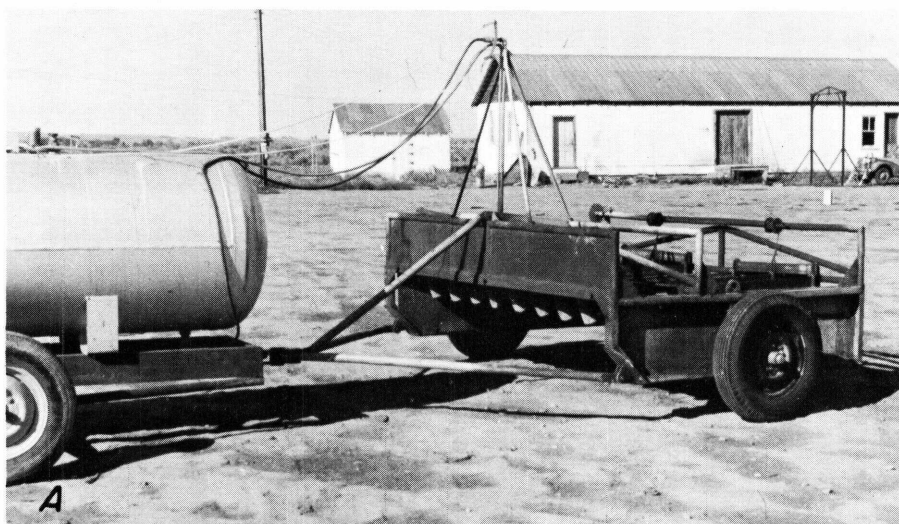
now in use, fueled with stove oil, propane, and butane. They burn swaths from 9 to 18 feet wide. All the burners, apparently, give satisfactory results if they are operated slowly enough to kill all alfalfa stubs to the crown, that is, at speeds not greater than 3 miles per hour. Where irrigation becomes necessary later in the season, it should be delayed as long as possible; then any dodder that germinates probably will do so too late to interfere with alfalfa seed production.

Burning may retard alfalfa regrowth by 7 to 10 days and thus delay maturing of the seed crop. In areas where there is danger that frost will prevent raising second-crop seed if burning is practiced, this danger can be reduced by cutting the first-crop hay about a week earlier than usual and burning the field before alfalfa regrowth begins.

Apparently second-crop alfalfa seed yields in burned-over fields may be less than those in fields free of dodder. However, burning of alfalfa fields heavily infested with dodder greatly increases their second-crop seed yields and greatly reduces the cost of cleaning the seed.

Custom burning usually costs \$5 to \$6.50 per acre; the cost depends on what fuel is used and how fast the burner is operated.

**CULTIVATION.**—Intensive cultivation after removal of first-crop hay gives good dodder control. In preparation for this treatment, on irrigated land, the field should be irrigated before the hay is cut. The hay should be removed as soon as possible, and the cultivation should follow immediately. Cultivation should be severe enough to kill all dodder plants left on the alfalfa stubs and to make conditions unfavorable for germination of others. It should



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**Figure 10.**—Types of field burner used for controlling dodder in second-crop alfalfa seed. **A**, A commercial burner fueled with liquid propane. Its 8 units burn a 9-foot swath. **B**, A home-made oil-type burner developed by two Utah farmers and used extensively. Its 8 units burn a 12-foot swath.

continue until all dodder has been destroyed and a dust mulch at least an inch deep has been formed. If done correctly, the cultivation will leave the field looking as if it had recently been plowed and harrowed to form a seedbed. The alfalfa will begin growing immediately, and if the surface soil remains dry good results can be expected.

**CHEMICALS.**—Spraying alfalfa stubble with contact herbicides after removal of first-crop hay is being practiced to some extent for dodder control. Most often, the herbicide used is a dinitro-fortified fuel oil or an emulsion of a dinitro-fortified fuel oil and water. In general, such treatments have not proved satisfactory, probably be-

cause dodder in stubble often is protected by trash or soil or forms such dense patches that it cannot be thoroughly covered with a spray. They have given better results if preceded by light cultivation, which breaks up the dodder mats and exposes them to the chemical.

### **Control in Hay and Forage Crops**

Where infestation becomes widespread in a crop that is being grown for hay or forage, it can be controlled (1) by mowing early for hay or silage and cultivating, (2) by grazing, or (3) by plowing the crop under and adopting a rotation of nonsusceptible crops. It should be borne in mind that even where maturing of dodder seed is prevented for as long as 5 years by such methods the weed may then reappear if an alfalfa crop is grown for seed or any other susceptible crop is planted. In most instances, however, after 5 years of such control a dodder infestation has been reduced to such an extent that it can be controlled with spot treatments.

#### **Early Mowing**

Where an infested alfalfa crop is to be utilized for hay or silage, cut early to prevent production of dodder seed. Remember that dodder on a crop used for hay sometimes matures seed even though cut at the flower stage. Whenever possible, if you must feed infested hay confine the animals to the field where it was cut. Use of such hay as silage involves no hazard if the

crop is cut before dodder seed matures. A harrowing between alfalfa crops helps to destroy dodder that is attached too low on the stem to be removed by mowing. If such dodder is not destroyed it probably will produce seed before the second crop is cut. Any later alfalfa crops, also, should be cut before dodder seed is produced.

#### **Grazing**

Where dodder is to be controlled by grazing, turn the animals into the field as soon as dodder begins to appear, and practice close grazing for the remainder of the season. For this purpose sheep are particularly good. Inspect the field during the season so as not to allow any dodder to go to seed. Because many weed species act as hosts to field dodder and common dodder, keep the fields and fence rows clean of weeds.

#### **Plowing and Crop Rotation**

A good way of utilizing a dodder-infested crop and controlling the infestation is to plow the crop under as green manure before any dodder seed has formed and then rotate nonsusceptible crops on the area for at least 5 years, keeping it free of weeds. In planning the rotation, select crops such as small grains; corn, potatoes, or other cultivated crops; and beans, peas, or other dodder-resistant legumes. Cultivation of the tilled crops will encourage germination of any dodder seed remaining in the soil, and any dodder seedlings that are not killed by the cultivation will die because they cannot find host plants.

## **CONTROLLING INFESTATION OF OTHER CROPS**

Where dodder is growing in vegetable crops or herbaceous ornamentals, no method is known for controlling the weed without killing the host plants. Growers of

these crops usually rogue out infested plants as soon as the dodder appears. Dodder on woody ornamentals can sometimes be controlled by removing it from the plants by

hand. This method, however, is time consuming and often gives only temporary results. Where dodder appears in planter boxes or flowerbeds for several years, changing the soil may solve the problem.

Dodder attacking plants that are being started in greenhouses, cold-frames, hotbeds, and other seedbeds is an annual problem in some areas. The control method com-

monly used is to treat the soil with live steam or a chemical soil fumigant such as methyl bromide before seeding. After such treatment about 95 percent of the dodder seed fail to germinate. Such treatment, at the same time, destroys other weeds and some insect pests. Any individual plants later attacked by dodder are immediately pulled by hand and destroyed.



